A British Medical Association Lecture

ON

CONGENITAL HYPERTROPHY OF THE PYLORUS.*

BY

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So much has been written in the last few years on congenital hypertrophy of the pylorus that one is almost inclined to apologize for broaching the subject again. It seems, however, worth while to sum up the results of one's experience when that experience is perhaps unusually large and extends far enough back to give some sort of perspective of progress in respect of the particular disorder, especially as to treatment.

In the past twenty-four years I have had under my own observation, either in my wards at hospital or in private practice, 248 cases of congenital hypertrophy of the pylorus. These figures must not be taken as indicating that the condition is of frequent occurrence. On the contrary, it is so uncommon that many practitioners of large experience tell me they have never seen a case. In the past, no doubt, congenital hypertrophy of the pylorus must often have run its course unrecognized, labelled perhaps "marasmus" or "chronic gastric catarrh"; but time has changed all this, and whereas in former years a case seen in consultation had almost invariably been undiagnosed, now the condition has almost always been suspected, if not recognized.

In outline the picture is now very generally known, thanks largely to the writings of Dr. John Thomson of Edinburgh. An infant three or four weeks old who has hitherto shown no tendency to vomit, or perhaps has posseted a mouthful or two, begins to vomit occasionally. The vomiting is not necessarily very frequent, perhaps only twice in the twenty-four hours, but the vomit is large and evidently consists of more than the last feed; moreover, it comes up with such force that it comes through nostrils as well as mouth. At the same time the bowels, which have been working with more or less regularity, become constipated, and the weight, which has been rising satisfactorily, ceases to increase and very soon begins to fall. In some cases it is this wasting rather than the vomiting which has aroused the mother's anxiety. On examination of the abdomen there is seen peristalsis of the stomach and the characteristic thickening of the pylorus is to be felt.

I shall proceed to consider this affection in detail, basing my remarks on my series of 248 cases. Unfortunately I find that in my notes I have sometimes omitted to record particular points, so that my figures will not on all points include the whole series.

This is one of the diseases in which sex incidence is as remarkable as it is difficult to interpret. Of 247 cases only 37 were girls, 210 were boys.

Place in family is much less definitely a predisposing factor than sex. In 114 cases out of 230 in which I have noted this point the infant was the first-born child; so that the proportion of first-born is about 50 per cent. I would point out that the proportion of first-born affected does not necessarily correspond to the liability of the first-born. In my opinion there is a special liability of the first-born to this, as also to other congenital abnormalities, but it is difficult to give any conclusive evidence of this, especially in these days when in many families there is only one child or two, so that the chance is considerable that a large proportion of persons showing any condition will be first-born.

In speaking of congenital hypertrophy of the pylorus as a congenital abnormality I do not mean to imply that the hypertrophy, or even the spasm that leads to hypertrophy, dates from birth; it is conceivable that it may do so, although the symptoms do not appear until the infant is about 2 to 4 weeks old. What is congenital is apparently some lack of stability, if I may put it so, in the harmony of gastric and pyloric relaxation and contraction, so that the child starts life with a machine which, although able to work passably well for a few weeks, is certain soon to get out of order. In this sense, at any rate, the disorder is congenital, and, like other congenital abnormalities, it is sometimes repeated in the same family. Amongst my 248 cases there were four instances of two cases of this affection occurring in the same family.

The age at which the first symptom appears—and for this purpose I have regarded vomiting as the first symptom—will be seen from the following table of 195 cases in which this point was noted:

Week of onset.	No. of cases.	Week of onset.	No. of cases.
1st	30	6th	6
2nd	38	7th	1
3rd	57	8th	7
4th	35	9th	1
5th	19	12th	1

SYMPTOMS AND DIAGNOSIS.

I propose now to consider the symptoms in detail with special reference to diagnosis.

Vomiting, constipation, and wasting: this is the combination which in any infant under 3 months of age should always suggest the possibility of congenital hypertrophy of the pylorus. The association of constipation with vomiting at any period of childhood should make one suspicious of serious organic disease, such as meningitis or some form of intestinal obstruction, and early infancy is no exception to this rule. The vomiting of digestive disturbance is likely to be associated with looseness of bowels rather than with constipation: there is also usually with it some abnormal appearance of the stools, whereas with congenital hypertrophy of the pylorus there is marked constipation and the stools are usually otherwise normal. The constipation is no doubt due to the smallness of the quantity of food which passes through the pylorus into the bowel, and the gradual disappearance of the constipation is one of the indications of lessening of the pyloric obstruction in cases which are treated by lavage of the stomach.

The vomiting varies remarkably in its frequency. There are cases, and I think the commoner, in which the vomiting is almost insidious in its onset, occurring at first perhaps only once or twice in twenty-four hours. The baby has posseted from time to time, and it was thought that this was due either to flatulence or to some indigestion; then a larger and more forcible vomit began to occur once or twice in the day, but there was no date to which the beginning of the trouble could be definitely referred. There are other cases in which upon a particular day the infant begins to vomit, never having vomited before, and the vomiting occurs after nearly every meal, so that hardly any food is retained. Naturally in the latter class of case the loss of weight is much more rapid than in the less acute cases. I have known such to lose weight at the rate of several ounces a day, whereas in the more common type, with vomiting perhaps twice daily, a loss of 5 or 6 oz. a week is more likely.

The character of the vomited material is worth observing, for it may give some clue to the state of the stomach. In the early stage it usually consists only of food, but as time goes on there is more and more tendency to vomiting of much glairy mucus, evidently pointing to a catarrhal condition of the mucous membrane, and this is often associated with considerable dilatation of the stomach; the stagnation of food not only distends the stomach but sets up a catarrhal condition of the mucosa, and sometimes brown shreds or even red clots of blood appear in the vomit. Occasionally, in spite of the situation of the obstruction in these infants, bilious material has appeared in the vomit. This is rare, but is of interest as showing that the closure of the pylorus is not continuous. If any proof were needed that the pyloric obstruction is intermittent, and is therefore due at least in part to spasm of the pylorus, it would be afforded by cases, not very rare in my experience, in which infants with peristalsis and tumour, proved subsequently by operation to be due to hypertrophy of the pylorus, have had intervals of two or three days, sometimes even as long as five days, when the vomiting has temporarily ceased entirely and food passes through the pylorus normally. I mention this not only because it throws light on the character of the obstruction, but also because it has sometimes raised doubts as to diagnosis, both in the parents' and in the doctor's minds, when the spasmodic nature of the obstruction has not been fully realized.

In this connexion also I would mention another feature which is usual in this disorder, though not peculiar to it—that each change of food is apt to be followed by lessening or cessation of the vomiting for twenty-four to forty-eight hours, after which the vomiting becomes as troublesome as

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before. This repeated temporary improvement is another source of error in diagnosis. A condition apparently so responsive to change of diet is thought to be simply a digestive trouble, and it is concluded that if only the right food could be found the trouble would disappear. So one finds that often food after food has been tried and the infant has gradually lost weight and strength before the possibility of pyloric obstruction is realized.

Now the diagnosis of congenital hypertrophy of the pylorus, unlike the diagnosis of many other disorders and diseases, is not a matter of opinion; it is demonstrable, and its demonstration consists in seeing waves of peristalsis in the hypertrophied and dilated stomach, and in feeling the hard and thickened pylorus. Visible peristalsis of the stomach in an infant is not necessarily an indication of any obstructive condition; its significance depends upon the degree of the peristalsis. Without organic disease of any sort a slight wave of peristalsis is sometimes to be seen in a thin infant towards the end of a meal, and I have thought this was specially noticeable in infants who were much subject to vomiting, apart from organic disease of any sort, but the waves are much less marked than those seen in congenital hypertrophy of the pylorus. Even the large wave which is such a striking feature of pyloric hypertrophy, the rounded bulging, varying in size from half a walnut up to half a Tangerine orange, and emerging from under the left costal margin to pass slowly across the epigastrium, separated by a depression from the succeeding wave, and this by yet another depression from another wave, is not necessarily pathognomonic of congenital hypertrophy of the pylorus. Exactly similar peristalsis has occurred in cases of stenosis of the duodenum, and I have seen one case in which such peristalsis occurred with complete obliteration of the duodenum. These duodenal cases are much rarer than pyloric obstruction.

Peristalsis of the stomach is certainly not in itself proof of congenital hypertrophy of the pylorus, though it may be admitted that when the peristaltic waves are large this is by far the most probable explanation.

The only absolute proof of pyloric hypertrophy, short of opening the abdomen and seeing it, is to feel the tumour. The pylorus in these cases is to be felt as a small barrel-shaped hard tumour, which, as palpated through the abdominal wall, gives the impression of varying in size from the thickness of an ordinary lead pencil up to that of a hazel nut. Its position is usually about 1 to 1½ inches above the level of the umbilicus, close to the right side of the vertebral column, so that it is usually necessary to press slightly inwards and very deeply under the right rectus muscle towards the vertebral column. The characteristic feature of the tumour is its disappearance, so far as palpability is concerned, when the pylorus is relaxed, so that, like an intussusception, the tumour may be quite obvious at one moment and a minute or so later it may not be felt. This variability in the hardness of the tumour is important in diagnosis, for it may be necessary to distinguish between hard scybala and the tumour due to hypertrophy of the pylorus. The contraction and hardening of the pylorus may be stimulated, when its position has been located, by gently kneading with the finger, which often helps considerably in demonstrating the tumour. How often is this tumour to be detected? Twice only in my 248 cases have I failed to feel it definitely, and one of these was moribund, so that examination could not be very thorough. Allowing for such rare failures, I think one would be right in saying that the tumour is to be felt in all cases, if sought in the proper way. The characteristic tumour makes the diagnosis certain, and in such a serious condition, if certainty is attainable, we have no right to be satisfied with anything less than certainty; for our diagnosis may involve an extremely grave operation. And yet I find that it is only seldom in cases seen in consultation that the tumour has already been felt.

In the first place, let it be recognized that, whilst in some cases the tumour is found at once and with ease, there are others in which it is only to be found by painstaking and prolonged searching. I have sometimes had to see an infant twice, or even three times, before I could be certain of the tumour.

If a casual poking of the finger-tips into the abdomen is expected to discover the tumour the result will usually be failure; one must be prepared to sit down before the infant, have a feed given, and patiently palpate the abdomen, it may be, for ten or fifteen minutes before the tumour is detected, and even then, if the movements of the stomach happen to be sluggish, one may fail to find the tumour until more brisk peristalsis occurs.

It is always advisable to have the infant fed during the examination, and this for three reasons:

1. The abdomen becomes relaxed, so that deep palpation is easy.
2. During the progress of the feed peristalsis of the stomach begins, and it is at this time that the pylorus is most likely to be felt.
3. If a full feed is given the pylorus is displaced somewhat downwards and to the right, so that it is more easily reached.

The cases in which the pyloric tumour is most difficult to detect are those in which the pylorus is, so to speak, tucked up high in the liver, and it is in such cases particularly that the giving of a large feed may assist detection of the tumour.

Prognosis and Treatment.

In 232 of my cases I have a record of the results (in 16 the notes were defective and the result not recorded); there was recovery in 156, death in 76. Of the fatal cases, 7 were in such an extreme condition of exhaustion when seen that either no treatment was possible or, at most, lavage was only just begun, and the child died within a week or less, several within twenty-four or forty-eight hours. These I shall omit from consideration, as they hardly affect the question of prognosis or treatment, except to emphasize the importance of early diagnosis. One may say, therefore, that 225 cases are available for considering the effect of treatment, and of these 156 recovered, 69 died. These figures, it must be remembered, cover a period of twenty-four years, and therefore include cases seen at a time when treatment was more tentative than it is now, and when surgery was invoked rather as a last and desperate resource than as an early and deliberate choice, which it usually is to-day. There is another point which must be considered if prognosis is to be based on statistics—namely, whether the figures are from cases treated in hospital or from cases treated in private, that is, in nursing homes or in the patient's own home. My own experience—and on this point I believe the experience of others has been the same—is that hospital results in this disorder are, for some reason difficult to ascertain, much less satisfactory than private results, and this holds good whatever method of treatment is adopted. If the figures given above are divided into these two categories the difference is evident:

	Recoveries.	Deaths.
Private cases	... 113	14
Hospital cases	... 43	55

No single cause seems sufficient to account for these differences; great efforts are made to obtain at least as good results in hospital as in private practice, and to some extent hospital results have improved in recent years. One factor which applies rather to my earlier cases than to those in recent years was the use of wet nurses, which certainly saved several of my private cases after operation; this has rarely been practicable in hospital. Anyone who is familiar with the treatment of infantile disorders in hospitals knows how often infants do badly with any condition, especially with any gastric or intestinal disorder, amongst a number of other ill children; they are specially apt to develop diarrhoea, and go down with symptoms suggestive of gastro-enteritis. Infants do best segregated as much as possible. This has, I think, something to do with the poor results in the hospital treatment of these pyloric cases. Whatever the explanation may be this difference has to be borne in mind in prognosis.

I pass now to the consideration of particular methods of treatment. Twenty years ago recovery by operation was regarded as a notable triumph of surgery, but since that time surgical technique has made such strides that recovery is now a commonplace; indeed, there is a tendency to lose sight of the fact that complete recovery can take place without operation at all. So far from operation being essential in all cases, there are some in which without special treatment of any kind beyond painstaking and efficient regulation of the feeding, generally in the direction of reducing the food to small quantities at short intervals, the tumour and peristalsis have gradually disappeared, and after many weeks or months of hovering on the verge of collapse the infant has completely recovered. Amongst my 156 recoveries there were six which were treated in this way,

and one in which after lavage had been perseveringly tried without success, the infant eventually recovered with prolonged care in feeding. Similar cases have been published by other observers. I mention this mode of treatment only as showing that the hypertrophy and obstruction can pass away spontaneously, but the chance of recovery by such treatment is probably extremely small. It must be remembered that a large proportion of the cases which have been eventually treated by other methods have been treated at first, and sometimes for several weeks, by dieting, and it is the failure of such treatment which has led to other methods being used.

Another line of treatment which has had so many successes that in former years it seemed only right to try it in all cases in the hope of avoiding what at that time was the much graver risk of operation, is stomach washing—lavage. Of 78 cases treated only by lavage 43 recovered, 35 died. It is only right to add that in former years I adopted this treatment always before resort to operation, so that these figures represent only those in which the result of lavage seemed sufficiently promising to justify continuance of it, a practice which eventually failed in some cases, as my figures show. But there are many others in which after lavage had been tried for some days or weeks the result, though sometimes a definite improvement, was not thought sufficiently good to justify postponing operation, so that my operation cases include many in which lavage had previously been done without effecting a cure.

Lavage, apart from its uncertainty of ultimate result, has drawbacks. Not all babies tolerate lavage; there are those who become so collapsed and exhausted by it that the lavage has to be abandoned. When it has been long continued I have known it to cause gastric irritation, so that the washing came back blood-stained and lavage had to be diminished or stopped. At the best it is only after many weeks of daily lavage, usually twice daily for a time and then once daily, that the condition is cured. I have generally reckoned twelve to sixteen weeks as the usual period during which lavage is necessary in cases which are cured by it. The gradual disappearance of the peristalsis and tumour under this treatment is very instructive as to the spasmodic origin of the hypertrophy. The vomiting ceases gradually, and is usually entirely stopped some weeks before the peristalsis and tumour have disappeared. The long duration of this treatment, the failure at first to gain weight, and then, after a week or two, the slow and unsteady gaining, make a trying ordeal for the parents, and the daily lavage necessitates either a specially trained nurse or a large amount of medical attendance, which is sometimes a practical difficulty.

With all its drawbacks, however, lavage has had sufficient successes, as my figures show, to justify its retention as a method of treatment which may be the best one to adopt in particular cases. Where the weight is only slowly falling and it is evident that a considerable amount of food passes through the pylorus, it may be right to try lavage and judge by daily weighing whether operation can still be postponed; but if the weight continues to fall, even for a few days, lavage should be abandoned. In cases where lavage succeeds the weight commonly ceases to fall, but does not rise during the first few days, perhaps not for a week or ten days, and then it begins slowly to rise. (I assume that the feeding is carefully regulated.)

In the decision as to whether operation or lavage should be the first line of treatment the possibility of obtaining surgery specially experienced in this disorder must weigh greatly. It makes a very great difference if the services of some surgeon who has operated upon many of these cases of congenital hypertrophy of the pylorus are available. Another point, and one of first-rate importance in the decision as to treatment, is the possibility of retaining the mother's milk. If the mother is still suckling the prolonged anxiety and the disturbances of suckling which are likely to be entailed by the lavage treatment will almost certainly end in loss of the breast milk, and this undoubtedly diminishes the prospect of success if operation becomes a necessity. My own feeling, therefore, is that when the mother is breast-feeding her infant it is usually the wisest course to proceed at once to operation, so that only with an interruption of forty-eight hours to allow for recovery from the immediate disturbance of operation the infant may continue the breast milk. Usually after a few hours' feeding with some watery solution such as glucose, and then a few more hours' feeding with milk pumped from the breast, the infant can within two or three days return to breast-feeding.

But if it is decided to operate there is still the question of method, and on this point the physician can only speak from his experience of results. Various operations have been tried; some have been abandoned by common consent. Pylorectomy, pyloroplasty, gastro-enterostomy are now things of the past so far as congenital hypertrophy of the pylorus is concerned. In two of my cases years ago gastro-enterostomy was done; both recovered, but in all the rest of the 139 cases in which operative treatment was adopted either forcible dilatation of the pylorus—that is, a modified Loreta operation—or in the last five years the Rammstedt operation, was done. The results of the various modes of treatment are perhaps best seen in the tabulated summary.

Results of Various Methods of Treatment of Congenital Hypertrophy of the Pylorus.

Method of Treatment.	Private Cases.		Hospital Cases.	
	Recovery.	Death.	Recovery.	Death.
Simple feeding	5	0	2	1
Lavage	24	6	19	29
Gastro-enterostomy ...	2	0	—	—
Forcible dilatation ...	74	6	12	16
Rammstedt	8	2	10	9

Anyone who has seen the Rammstedt operation—that is, a longitudinal incision through the peritoneal coat and muscular layers of the pylorus, leaving the mucosa intact—can hardly fail to have been impressed with its simplicity and rapidity, and it has already become the generally approved operation for congenital hypertrophy of the pylorus. But, as my figures show, it is by no means free from danger. The deaths from the Rammstedt operation in my fatal cases have, I think, all been within a few days afterwards; sometimes from bleeding from the pyloric incision into the peritoneal cavity, sometimes from shock, sometimes from collapse within two or three days, but always (except in one case where the child died when the recurrence of symptoms necessitated a second operation) as a direct result of the operation. So that although it offers great advantages and is no doubt the operation which most surgeons will adopt, it has a considerable mortality, and at present I have but seldom had it done in my private cases. Indeed, the results of forcible dilatation have been so good, especially in recent years, that it is hardly likely better could be obtained.

The operation of forcible dilatation has been done in nearly all my cases by Mr. F. F. Burghard, and the proportion of recoveries in the private cases hardly does justice to his recent results. These in the past few years show a much higher proportion of successes. In the past eight years Mr. Burghard has performed this operation on forty-six of my private cases, with only one death. It is clear that this operation, as done by him, has given results at least as good as those obtained by the Rammstedt operation. But this no doubt depends very largely on the particular operator and cannot be taken as proving that the operation itself is as good as, or better than, the Rammstedt method; indeed, in the hands of some surgeons it has had very little success. The hospital mortality of these forcible dilatation cases has, in my experience, been much less often due directly to the operation than is the mortality of the Rammstedt procedure; death has occurred more often after many days or weeks from gastro-intestinal disturbance or marasmus.

By whatever treatment recovery is obtained the recovery seems to be complete. It is true that recurrence has taken place both with Rammstedt operation and with the forcible dilatation, but this happens within ten days after the operation; it occurred three times amongst my earlier cases treated by dilatation, necessitating a further dilatation, which in each case was followed by recovery. It happened once also amongst those treated by the Rammstedt method, but in this case a second operation by the same method proved fatal. With increased experience of the degree of stretching needed in the one case and of the length of the incision needed in the other, recurrence is now hardly to be feared.

I have seen or heard of many of my cases years afterwards. The hypertrophy of the pylorus, whether treated by simple feeding, lavage, or operation, has seemed to leave no after-effect; they have been as a rule particularly healthy and fine children.